

APPENDIX E: RELIABILITY ANALYSIS ASSUMPTIONS AND METHODOLOGY

Below are several tables and figures supporting the transmission system and forced outage rate analysis detailed in Chapter 3.

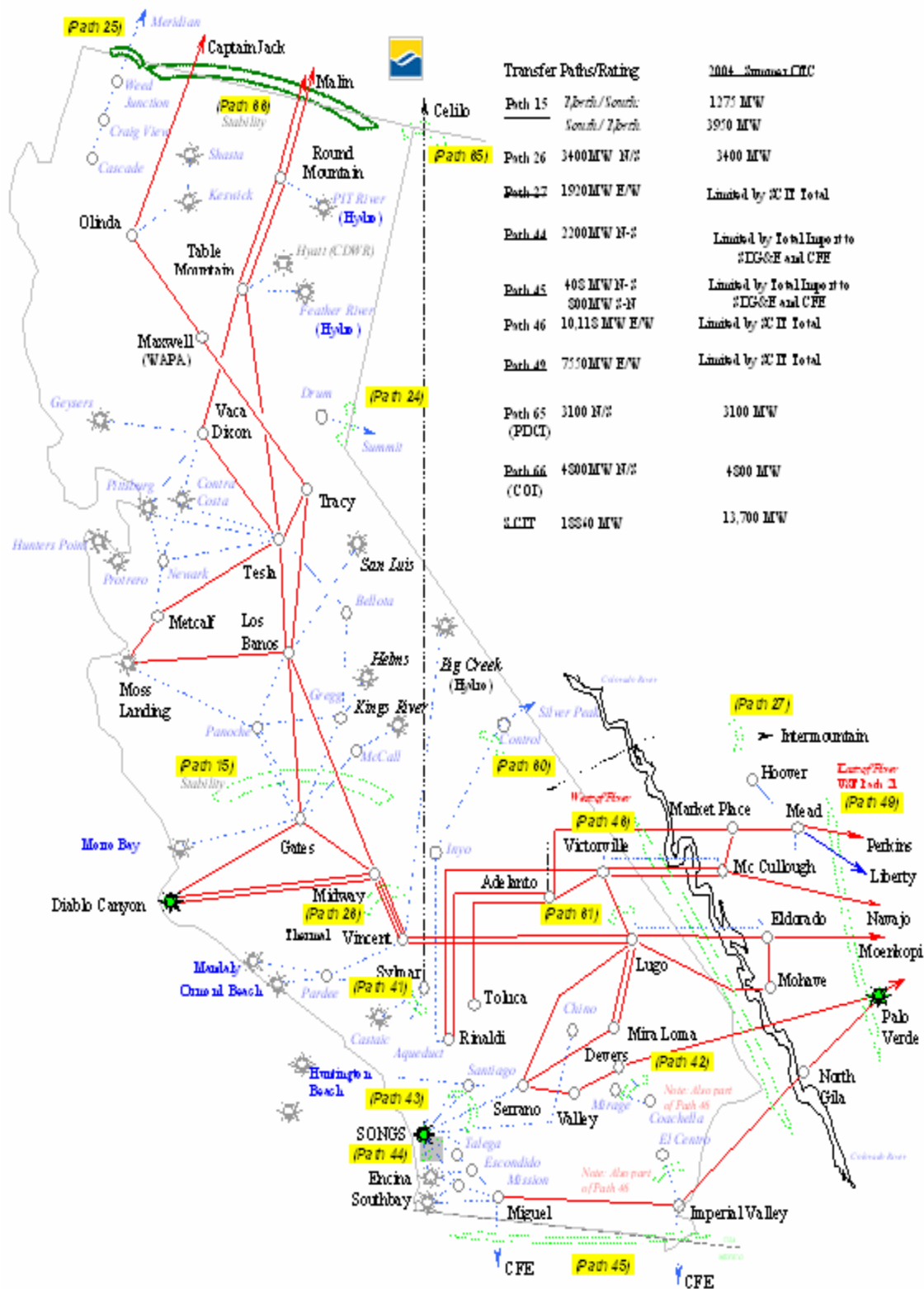


Figure 1: California EHV System

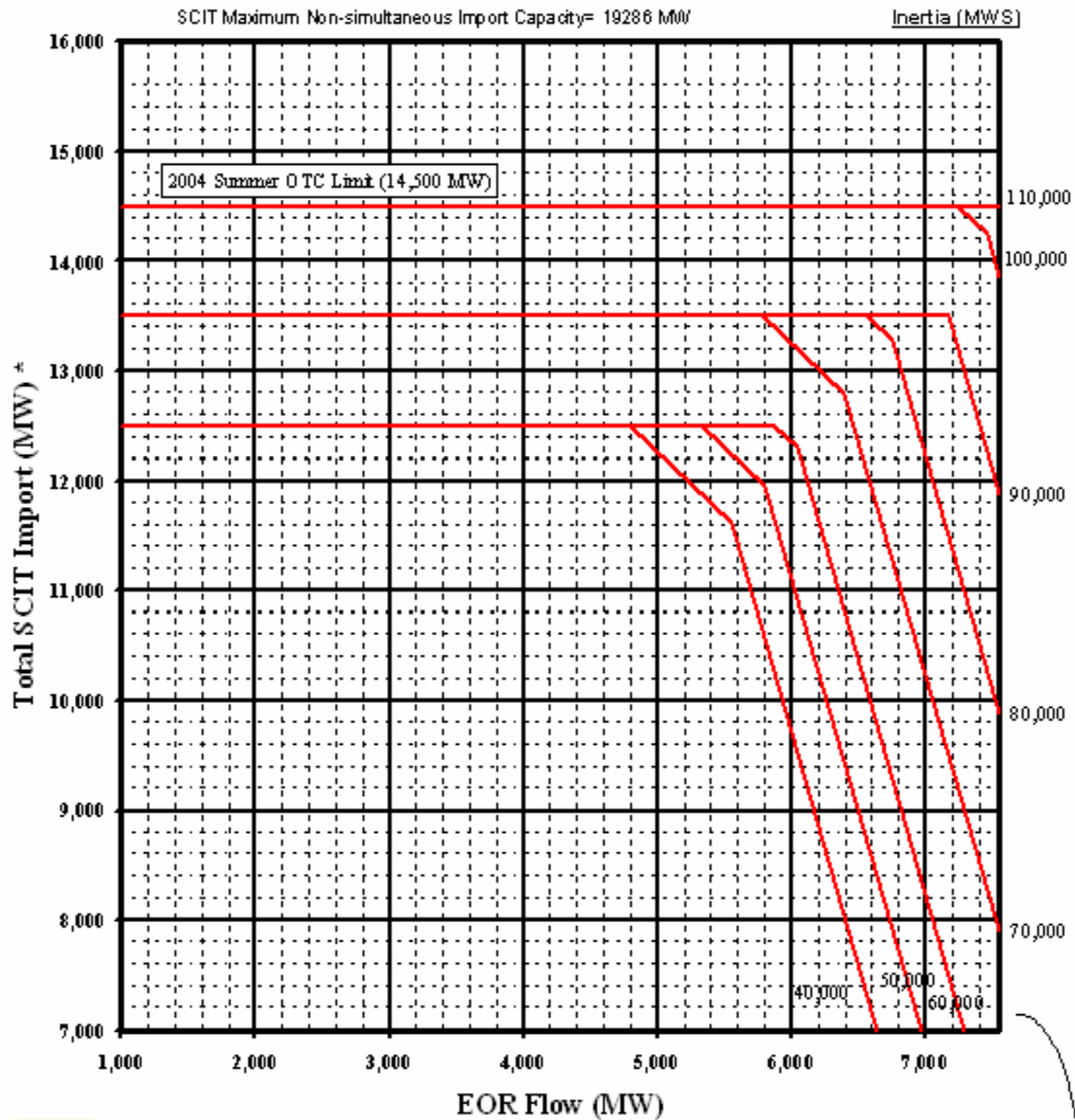


East-of-River/Southern California Import Transmission Nomogram

Based upon:
Three Palo Verde units
All transmission facilities in service

Reduction in SCIT Import Limit For Palo Verde Status:	
3 units on Line	0 MW
2 units on Line	200 MW
1 unit on Line	400 MW
0 unit on Line	700 MW

500 MW Operating Margin Taken Normal to the Limits



Revised 3/18/2004
CAISO

EOR Maximum Non-simultaneous Rating = 7550 MW

*Sum of flows on Midway-Vincent, PD CI, IPP, North of Lugo, and W OR.

Figure 2: 2004 Summer SCIT Nomogram

TABLE 6
CEC AGING POWER PLANT STUDIES
SUMMARY OF NORTHERN SYSTEM BASE CASES
USED FOR N-1 ANALYSIS

	2005		2007			2008		
	base	high [*]	base	high [*]	high+med	base	high	high+med
Imports/Path Flows (MW)								
COI	4,611		4,629		4,655	4,613	4,644	4,666
PDCI	3,095		3,098		3,091	3,101	3,101	3,103
Path 26	3,397		3,170		2,717	3,399	3,433	2,902
Path 15	425		558		374	355	765	642
Total Import (COI - Path 26)	1,214	0	1,459	0	1,938	1,214	1,211	1,764
PG&E Area Resources (MW)								
On-Line Generation								
Existing	24,342	0	24,338	0	23,898	25,772	25,644	24,802
Cosumnes	500		500		500	0	150	500
Metcalf			600		600	600	600	600
Total	24,842		25,438		24,998	26,372	26,394	25,902
Imports	1,214	0	1,459	0	1,938	1,214	1,211	1,764
Total Resources	26,056	0	26,897	0	26,936	27,586	27,605	27,666
High Probability Retirements								
Contra Costa 6	----	----	----	----	----	----	340	340
Morro Bay 1 & 2	----	326	----	326	326	----	326	326
Pittsburg 7	----	----	----	----	----	----	720	720
Subtotal	0	326	0	326	326	0	1,386	1,386
Medium Probability Retirements								
Contra Costa 6	----	----	----	----	340	----	----	----
Contra Costa 7	----	----	----	----	----	----	----	340
Morro Bay 3 & 4	----	----	----	----	676	----	----	676
Pittsburg 5 & 6	----	----	----	----	----	----	----	650
Pittsburg 7	----	----	----	----	720	----	----	----
Subtotal	0	0	0	0	1,736	0	0	1,666
Total Retirements	0	326	0	326	2,062	0	1,386	3,052
PG&E N-0 Overloads (%)								
Atlantic 230/60 kV transformer #1			103		103	119	119	119
Lakeville 230/60 kV Transformer #3						110	110	111
McDwllSW - Petaluma C 60 kV #1						106	106	106
Vaca-Dixon 115/60 kV Transformer #5						105	105	105
Tulucay 230/60 kV Transformer #1						102	102	102
McDwllSW - Lakeville 60 kV #1						100	101	101
Glass - Madera 70 kV #1			101		101			
* High probability units in both 2005 and 2007 were already off-line in the base case. Therefore no high probability base case was created.								

TABLE 7											
CEC AGING POWER PLANT STUDIES											
SUMMARY OF SOUTHERN SYSTEM BASE CASES USED FOR N-1 ANALYSIS											
	2005		2006			2007			2008		
	base	high	base	high	high+med	base	high	high+med	base	high	high+med
Imports/Path Flows (MW)											
Path 26 Flows	3,372	3,363	3,351	3,352	3,376	3,359	3,352	3,441	3,341	3,340	3,468
IPP DC	1,854	1,854	1,854	1,854	1,854	1,854	1,854	1,854	1,561	1,561	1,561
West-of-River	5,184	5,168	5,180	5,165	5,162	5,330	5,312	6,218	5,467	5,455	7,303
PDCI	2,705	2,713	2,734	2,735	2,711	2,723	2,730	2,706	2,731	2,732	2,732
North-of-Lugo	1,468	1,355	1,452	1,340	1,339	1,435	1,322	1,323	1,430	1,317	875
Total SCIT	14,583	14,453	14,571	14,446	14,442	14,701	14,570	15,542	14,530	14,405	15,939
SCE Area Resources (MW)											
On-Line Generation											
Existing	13,318	13,204	12,711	12,694	12,642	12,552	12,529	11,526	13,007	12,984	11,184
Pastoria	250	250	250	250	250	750	750	750	750	750	750
Mountain View	0	0	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056	1,056
Total	13,568	13,454	14,017	14,000	13,948	14,358	14,335	13,332	14,813	14,790	12,990
Imports	8,419	8,419	8,419	8,419	8,419	8,579	8,579	9,589	8,589	8,589	10,389
Total Resources	21,987	21,873	22,436	22,419	22,367	22,937	22,914	22,921	23,402	23,379	23,379
High Probability Retirements											
Coolwater 1 & 2	----	140	----	140	140	----	140	140	----	140	140
Long Beach 8 & 9	----	295	----	295	295	----	295	295	----	515	515
Mountain Vista 3 & 4	----	0	----	0	0	----	640	640	----	640	640
Subtotal	----	435	----	435	435	----	1,075	1,075	----	1,295	1,295
Medium Probability Retirements											
Mandalay 1 & 2	----	----	----	----	420	----	----	420	----	----	420
Ormond Beach 1 & 2	----	----	----	----	1,400	----	----	1,400	----	----	1,400
El Segundo 3 & 4	----	----	----	----	0	----	----	660	----	----	660
Coolwater 3 & 4	----	----	----	----	0	----	----	0	----	----	470
Subtotal	----	----	----	----	1,820	----	----	2,480	----	----	2,950
Total Retirements	----	435	----	435	2,255	----	1,075	3,555	----	1,295	4,245
SCE N-0 Overloads (%)											
SDG&E Area Resources (MW)											
On-Line Generation											
Existing	1,416	1,416	1,522	1,521	1,518	1,095	1,094	1,093	575	575	384
Palomar	0	0	0	0	0	546	546	546	546	546	546
Otay Mesa	0	0	0	0	0	0	0	0	590	590	590
Total	1,416	1,416	1,522	1,521	1,518	1,641	1,640	1,639	1,711	1,711	1,520
Imports	2,502	2,503	2,490	2,492	2,503	2,475	2,480	2,471	2,510	2,511	2,680
Total Resources	3,918	3,919	4,012	4,013	4,021	4,116	4,120	4,110	4,221	4,222	4,200
High Probability Retirements											
South Bay 1-4	----	----	----	----	----	----	----	----	----	170	170
Medium Probability Retirements											
South Bay 4	----	----	----	----	170	----	----	210	----	----	0
Encina 1-5	----	----	----	----	0	----	----	0	----	----	231
Subtotal	----	----	----	----	170	----	----	210	----	----	231
Total Retirements	----	----	----	----	170	----	----	210	----	170	401
SDG&E N-0 Overloads (%)											
Miguel 230/138-kV Transformer									122	133	141
Miguel 230/69-kV Transformers									112	114	106
Miguel-Proctor Valley 138-kV Line										105	116
So. Bay-Tele. Cnyn 138-kV Line										105	117
Mission-Friars 138-kV Line											142
Friars-Doublet Tap 138-kV Line											123
Tele. Cnyn-Proctor Vy. 138-kV Line											107
Sycamore-Scripps 69-kV Line											115

TABLE 8
CEC AGING POWER PLANT STUDIES
SUMMARY OF MOST SEVERE N-1 OVERLOADS

	2005		2006			2007			2008		
	base	high	base	high	high+med	base	high	high+med	base	high	high+med
In SCE Area											
Vincent-Antelope 230	101	100	106	105	115	--	--	105	--	--	--
Victor-Lugo #1 or #2 230	108	102	106	100	101	104	--	--	104	104	--
Kramer-Lugo #1 or #2 230	149	134	148	133	133	147	132	132	150	150	--
Devers #1 500/230	99	99	--	--	--	--	98	109	--	--	102
Lugo #1 or #2 500/230	120	111	119	111	111	117	109	110	119	119	--
Mira Loma #1 500/230	100	99	--	--	--	--	100	--	--	--	102
Mira Loma #3 500/230	102	101	--	--	--	--	101	98	99	99	104
Mira Loma #4 500/230	103	102	--	--	--	--	103	100	100	100	105
Vincent #1 500/230	106	104	111	110	119	109	105	126	107	107	129
Valley #1 500/115	--	--	99	99	99	100	100	100	110	110	111
Valley #2 500/115	--	--	--	--	--	--	--	--	110	110	111
Valley #3 500/115	--	--	99	99	99	100	100	100	109	109	110
Valley #4 500/115	--	--	--	--	--	--	--	--	109	109	110
Vincent #3 500/230	--	--	--	--	--	--	--	101	--	--	103
Vincent #4 500/230	--	--	--	--	101	--	--	105	--	--	107
La Fresa-Redondo #1 or #2 230	--	--	--	--	--	--	--	128	--	--	127
Victorville-Lugo 500	--	--	--	--	--	--	--	--	--	--	101
In SDG&E Area											
Miguel 230/138-kV Transformer									121	130	135
Miguel-Proctor Valley 138-kV Line									114	123	137
Proctor Valley-Telegraph Canyon 138-kV Line									105	114	127
Telegraph Canyon-South Bay 138-kV Line									105	115	129
Mission-Friars 138-kV Line									116		168
Sycamore 230/69-kV Transformers									109	107	1/
Miguel 500/230-kV #1 Transformer						106	105	108	108	107	120
Miguel 500/230-kV #2 Transformer						107	106	109	107	106	119
Miguel 230/69-kV Transformers										102	1/
Friars-Doublet Tap 138-kV Line											148
Doublet Tap-Mira Sor 138-kV Line											109
Miguel-Otay Mesa #1 or #2 230-kV Line											112
Mission-Old Town 230-kV Line											103
					1/	Most severe outage diverged					

Table 13 SCIT Homogram Maximum Import Limit Sensitivity Study Results																					
Songs G-2 Contingency																					
Case Ilo.	Case	Year	Flows (MW)								SCIT Inertia (MWs) ⁶	Reactive Margin (MVar)									
			SCIT	COI	PATH 26	WOR	EOR	PDCI	IPP DC	CA - CFE		MALIN 500	TABLE MT 500	VICTOR-VL 500	DEVERS 500	MIRA-LOMA 500	MIGUEL 500	MIGUEL 230	T.JI-230 230	SOUTH-BAY 138	SOUTH-BAY 69
1	05hs_s134m2.sav	2005	13412	4741	3326	4629	3864	3104	1648	1	127531	757	821	108	58	56	31	25	27	20	17
2	05hs_s135m2.sav	2005	13510	4735	3326	4726	3959	3104	1648	2	125994	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
3	05hs_s134m2ageH.sav ¹	2005	13420	4736	3327	4715	3953	3104	1648	1	126906	750	697	76	45	42	24	19	21	15	13
4	05hs_s135m2ageH.sav ¹	2005	13519	4741	3332	4808	4040	3104	1648	2	125369	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
5	07hs_s14740m2	2007	14740	4792	3419	5662	4821	3085	1648	-231	136852	798	802	120	68	68	32	26	29	20	17
6	07hs_s14839m2	2007	14839	4825	3424	6018	5138	3080	1648	-243	136852	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
7	07hs_s14747m2hi ²	2007	14747	4823	3420	6006	5137	3082	1648	-242	136227	693	536	41	32	31	16	12	15	10	9
8	07hs_s14788m2hi ²	2007	14788	4825	3424	6044	5177	3081	1648	-243	136227	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
9	07hs_s14546m2med ³	2007	14546	4792	3446	5764	4929	3104	1648	-237	131428	866	955	127	102	99	25	20	22	14	12
10	07hs_s14644m2med ³	2007	14645	4797	3453	5857	5017	3104	1648	-240	131428	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
12	08hs_s148m2.sav	2008	14797	4815	3415	6006	5145	3077	1648	-244	138120	889	1031	128	142	148	41	33	37	24	20
14	08hs_s149m2.sav	2008	14898	4800	3397	6092	5227	3104	1648	-247	138120	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
15	08hs_s144m2H.sav ⁴	2008	14399	4800	3399	5699	4874	3079	1648	-236	137433	762	712	54	76	50	17	14	15	10	9
16	08hs_s145m2H.sav ⁴	2008	14502	4804	3403	5799	4965	3078	1648	-239	137433	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged	diverged
1) High Probability Units retired: Coolwater 1 & 2 (Alta 1 & 2), Long Beach (Long Beach already off in base case)																					
2) High Probability Units retired: Coolwater 1 & 2 (Alta 1 & 2), Etiwanda (Mtn Vista), Long Beach (Etiwanda & Long Beach already off in base case)																					
3) High & Med Prob.Units Retired; High Prob. Units + Elsegundo, Mandalay, Ormond,+South Bay #4. Add 700 MW SCE gen at Alamt 7, SeaWest, & Wintec. Schedule 1100 MW from LADWP to SCE, Add 1100 MW LADWP Gen at Haynes, Scattergood, Castaic																					
4) High Probability Units retired: Coolwater 1 & 2 (Alta 1 & 2), Etiwanda (Mtn Vista), Long Beach, South Bay 1-4 (Etiwanda, Long Beach, and South Bay 1-2 already off in base case)																					
5) SCIT Inertia value does not include the inertia from IV-Gen																					

Proposed List of Plants for APPS Reliability Analysis									
Unit Identification				ER 94 ESPAR ¹		Retirement Risk			
	Owner	Plant	Unit	Year	Capacity (MW)	2005	2006	2007	2008
1	Mirant	Contra Costa	6	1964	340	L	M	→	H
2	Mirant	Contra Costa	7	1964	340	L	L	→	M
6	Duke	Morro Bay Power Plant	1	1956	163	H	H	H	H
7	Duke	Morro Bay Power Plant	2	1955	163	H	H	H	H
8	Duke	Morro Bay Power Plant	3	1962	338	L	M	M	M
9	Duke	Morro Bay Power Plant	4	1963	338	L	M	M	M
10	Duke	Moss Landing Power PI	6	1967	739	L	L	L	L
11	Duke	Moss Landing Power PI	7	1968	739	L	L	L	L
12	Mirant	Pittsburg Power	5	1960	325	L	L	→	M
13	Mirant	Pittsburg Power	6	1961	325	L	L	→	M
14	Mirant	Pittsburg Power	7	1972	720	L	M	→	H
15	Mirant	Potrero Power	3	1965	207	L	L	L	L
16	Dynegy/NRG	Encina	1	1954	107	L	L	L	M
17	Dynegy/NRG	Encina	2	1956	104	L	L	L	M
18	Dynegy/NRG	Encina	3	1958	110	L	L	L	M
19	Dynegy/NRG	Encina	4	1973	293	L	L	L	M
20	Dynegy/NRG	Encina	5	1978	315	L	L	L	M
21	Port of San Diego/Duke ⁸	South Bay Power Plant	1	1960	147	L	L	→	H
22	Port of San Diego/Duke ⁸	South Bay Power Plant	2	1962	150	L	L	→	H
23	Port of San Diego/Duke ⁸	South Bay Power Plant	3	1964	171	L	L	→	H
24	Port of San Diego/Duke ⁸	South Bay Power Plant	4	1971	222	L	M	→	H
25	AES	AES Alamos LLC	1	1956	175	L	L	L	L
26	AES	AES Alamos LLC	2	1957	175	L	L	L	L
27	AES	AES Alamos LLC	3	1961	320	L	L	L	L
28	AES	AES Alamos LLC	4	1962	320	L	L	L	L
29	AES	AES Alamos LLC	5	1969	480	L	L	L	L
30	AES	AES Alamos LLC	6	1966	480	L	L	L	L
31	Reliant	Coolwater	1	1961	65	H	H	H	H
32	Reliant	Coolwater	2	1964	81	H	H	H	H
33	Reliant	Coolwater	3	1978	241	L	→	→	M
34	Reliant	Coolwater	4	1978	241	L	→	→	M
35	Dynegy/NRG	El Segundo Power	3	1964	335	L	L	M	M
36	Dynegy/NRG	El Segundo Power	4	1965	335	L	L	M	M
37	Reliant	Etiwanda Generating St	3	1963	320	L	L	H	H
38	Reliant	Etiwanda Generating St	4	1963	320	L	L	H	H
39	AES	AES Huntington Beach	1	1958	215	L	L	L	L
40	AES	AES Huntington Beach	2	1958	215	L	L	L	L
41	Dynegy/NRG	Long Beach Generation	8	1976	303	H	H	H	H
42	Dynegy/NRG	Long Beach Generation	9	1977	227	H	H	H	H
43	Reliant	Mandalay	1	1959	215	L	M	M	M
44	Reliant	Mandalay	2	1959	215	L	M	M	M
45	Reliant	Ormond Beach	1	1971	750	L	M	M	M
46	Reliant	Ormond Beach	2	1973	750	L	M	M	M
47	AES	AES Redondo Beach LL	5	1954	175	L	L	L	L
48	AES	AES Redondo Beach LL	6	1957	175	L	L	L	L
49	AES	AES Redondo Beach LL	7	1967	480	L	L	L	L
50	AES	AES Redondo Beach LL	8	1967	480	L	L	L	L
51	PG&E	Humboldt Bay	1	1956	52	L	L	L	L
52	PG&E	Humboldt Bay	2	1958	53	L	L	L	L
53	PG&E	Hunters Point	4	1958	163	L	L	L	L
Total					14,712				

Exhibit 1: Proposed Power Plant Retirement List

